

RESEARCH REPORT SERIES no. 20-2012

I, 3, AND 5 HIGHER STREET,  
DARTMOUTH, DEVON  
**TREE-RING ANALYSIS OF TIMBERS**

SCIENTIFIC DATING REPORT

Martin Bridge



INTERVENTION  
AND ANALYSIS



ENGLISH HERITAGE

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Dr M C Bridge

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## **SUMMARY**

A total of sixteen timbers were sampled from various elements of the western side of the building complex fronting onto Higher Street, numbers 1, 3 and 5, including three major beams from the rear areas of these buildings. Two of the samples that had retained complete sapwood, matched with each other, and were found to have been from trees felled in the same year. One of these was from the northernmost rooms (1 Higher Street) and one from 3 Higher Street, showing that these two ceilings were likely to have been constructed at the same time. However, neither these, nor any other of the eleven series with sufficient rings to make measurement worthwhile, could be dated.

## **CONTRIBUTORS**

Dr M C Bridge

## **ACKNOWLEDGEMENTS**

This work was commissioned by Dr Peter Marshall (English Heritage Scientific Dating Team). Access to the site was arranged through Colin Souch of Paul Carpenter Associates. He was most helpful, as were the site contractors. John Thorp of Keystone Historic Building Consultants provided various plans and drawings of the site adapted here to show sampling locations. Cathy Tyers (Sheffield University Dendrochronology Laboratory) made useful comments on earlier drafts of this report.

## **ARCHIVE LOCATION**

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Exeter EX2 4QW

## **DATE OF INVESTIGATION**

2011

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## INTRODUCTION

The row of buildings comprising 1, 3, and 5 Higher Street is located in the centre of the town (Figs 1 and 2) and has been variously divided in historic times. The northern end of the row (1 and 3 Higher Street), grade II listed, is described as 'The Shambles' in the National Heritage List for England description (<http://list.english-heritage.org.uk/>), and is attributed to the early/mid seventeenth century, with various later alterations, and extensive refurbishment *c* 1955. The southern part of the row (5 Higher Street), grade II\* listed, is thought to have been built around AD 1635, and underwent a major repair programme *c* 1960. Some of the rear (more eastern) parts of the property were thought to be possibly older.

An extensive fire in 2010 made the buildings structurally unsound. This resulted in the initiation of a major programme of stabilisation of the front (west) of the building, followed by a programme of repair. The English Heritage Historic Buildings Inspector, Francis Kelly, requested dendrochronological dating of the properties in order to inform this programme of stabilisation and repair being undertaken by the local council on these listed buildings.

Some timbers were highlighted as of particular interest with respect to the historic development of this row. These included the front (west) beam above the entry door of number 5 and the surviving ground-floor floor beams to the rear of the property which were hence given priority in the sampling strategy.

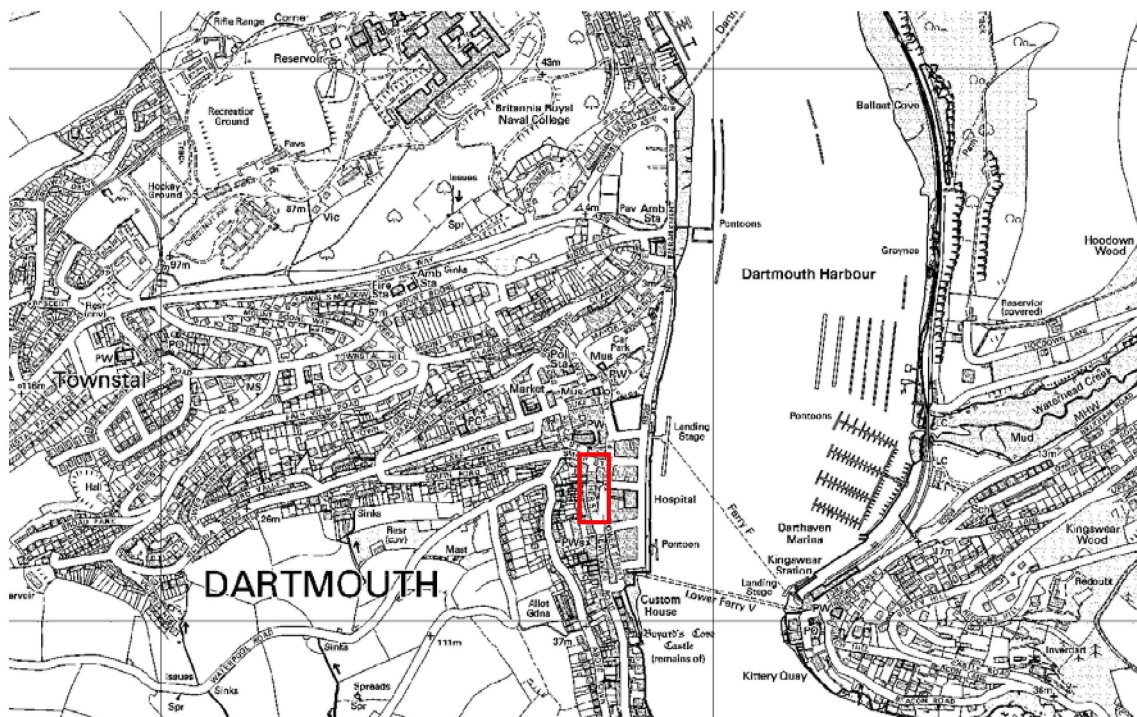
## METHODOLOGY

Fieldwork for the present study was carried out in February 2011, following an earlier assessment at the end of 2010. In the initial assessment accessible oak timbers with more than 50 rings, and where possible traces of sapwood, were sought. The number of such timbers was relatively small, and there was a lack of complete sapwood visible, although access was somewhat limited following the extensive fire. Many timbers were heavily scorched, especially those in the southern part of the property (5 Higher Street). A number of large beams between the cellar and ground floor were visible from a distance during assessment, but could not be safely accessed until the fieldwork phase. During the fieldwork phase, those in situ timbers judged to be potentially useful were cored using a 15mm auger attached to an electric drill. The cores were labelled, and stored for subsequent analysis.

The cores were subsequently mounted and polished on a belt sander using 80 to 400 grit abrasive paper to allow the ring boundaries to be clearly distinguished. The samples had their tree-ring sequences measured to an accuracy of 0.01mm, using a specially constructed system utilising a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC, which recorded the ring widths into a dataset. The software used in measuring and subsequent analysis was written by Ian

Tyers (2004). Cross-matching was attempted by a combination of visual matching and a process of qualified statistical comparison by computer. The ring-width series were compared for statistical cross-matching, using a variant of the Belfast CROS program (Baillie and Pilcher 1973). Ring sequences were plotted to allow visual comparisons to be made between sequences. This method provides a measure of quality control in identifying any potential errors in the measurements when the samples cross-match.

In comparing one sample or site master against other samples or chronologies,  $t$ -values over 3.5 are considered significant, although in reality it is common to find demonstrably spurious  $t$ -values of 4 and 5 because more than one matching position is indicated. For this reason, dendrochronologists prefer to see some  $t$ -value ranges of 5, 6, and higher, and for these to be well replicated from different, independent chronologies with both local and regional chronologies well represented, except where imported timbers are identified.



*Figure 1. Map to show the location of Higher Street within Dartmouth. ©Crown Copyright. All rights reserved. English Heritage 100019088. 2012*



*Figure 2. Map showing the location of 1, 3, and 5 Higher Street within their immediate environs. ©Crown Copyright. All rights reserved. English Heritage 100019088. 2012*

## RESULTS AND DISCUSSION

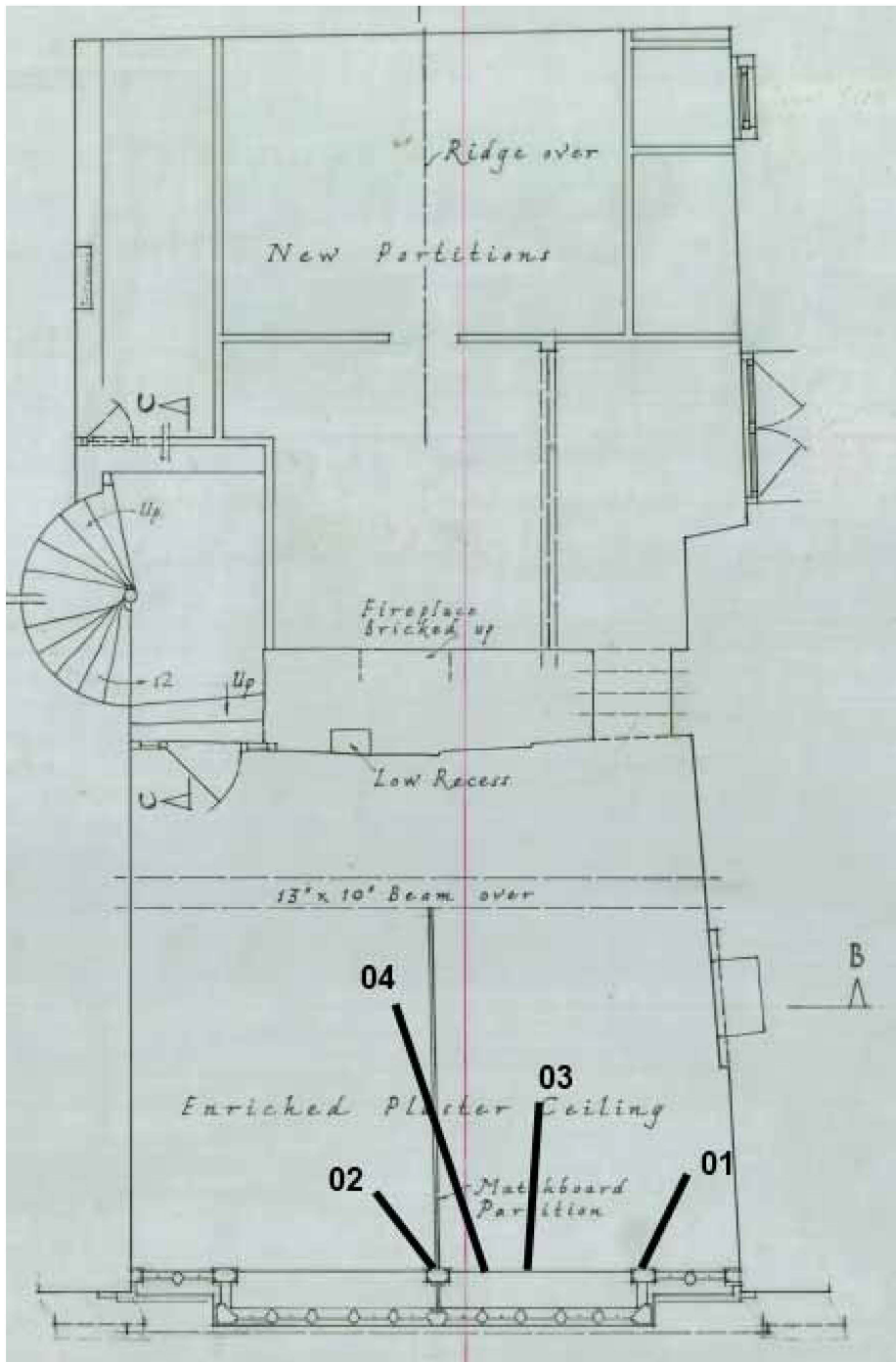
During the initial assessment, a large group of *ex situ* timbers that had been removed to storage were inspected, but all were found to contain too few rings to be of use for dendrochronology. This assessment had however concluded that there were some *in situ* timbers with sufficient numbers of rings that might have potential for dendrochronological dating, but that overall the prospects were relatively poor. However the decision was taken that sampling should proceed.

The beam above the door to 5 Higher Street, highlighted as of particular interest, was severely compromised, being supported by props. After careful inspection it was decided that access to this beam for coring at any appropriate angle to get what appeared anyway to be a relatively short ring sequence was not possible with safety both with regard to the integrity of the timber and the person doing the coring. The large beams in the rear of the building complex were only seen from a distance during assessment. During the sampling phase, these beams had been exposed, and access was possible from below (because of the sloping ground, they form the ground floor to the east side of the buildings, but they appear as cellars to the seventeenth-century frontage to Higher Street). Two of these beams were sampled, but the other two were found to be of softwood, and were not sampled.



A total of 16 timbers were sampled, covering a range of elements. Basic information about the samples taken is presented in Table 1 with the raw ring-width data of the measured samples being given in the Appendix. Positions of timbers sampled are shown in Figs 3-8. Four series contained less than 45 rings and these were not included in further analysis. Three series contained only 48 rings, less than desirable, but these were measured in the hope that these relatively short series might match others from this site, especially as one of them retained complete sapwood.

Only two of the samples cross-matched with each other, samples 15 and 16 ( $t = 5.2$  with 89 years overlap). Both had complete sapwood ending in the same calendar year (Fig 9), and both were major ceiling beams, one from the central section (3 Higher Street) of this complex and one from the north end of the complex (1 Higher Street) which is adjacent to Smith Street. This suggests that these two ceilings are coeval though clearly this interpretation rests on a single, albeit main beam, in each ceiling and hence could be taken to imply that this northern half of the complex was built as a single unit. Unfortunately, despite the 93-year series produced by combining these matched individual tree sequences, no date was obtained when it was compared with dated reference material. None of the other series matched each other, and none could be dated individually against the reference material. The whole complex therefore remains undated dendrochronologically. Being so close to the river in this old port town, and bearing in mind that until the nineteenth century most materials reached Dartmouth by water as land-access was virtually non-existent (Kelly *pers comm*), it is possible that timber was brought in from a range of sources, albeit relatively local. It should also be noted that timber used in this part of Devon has proved difficult to date in the previous analyses.



*Figure 3. Part of the 1948 plans, showing the timbers sampled from the first floor of 5 Higher Street, Dartmouth*

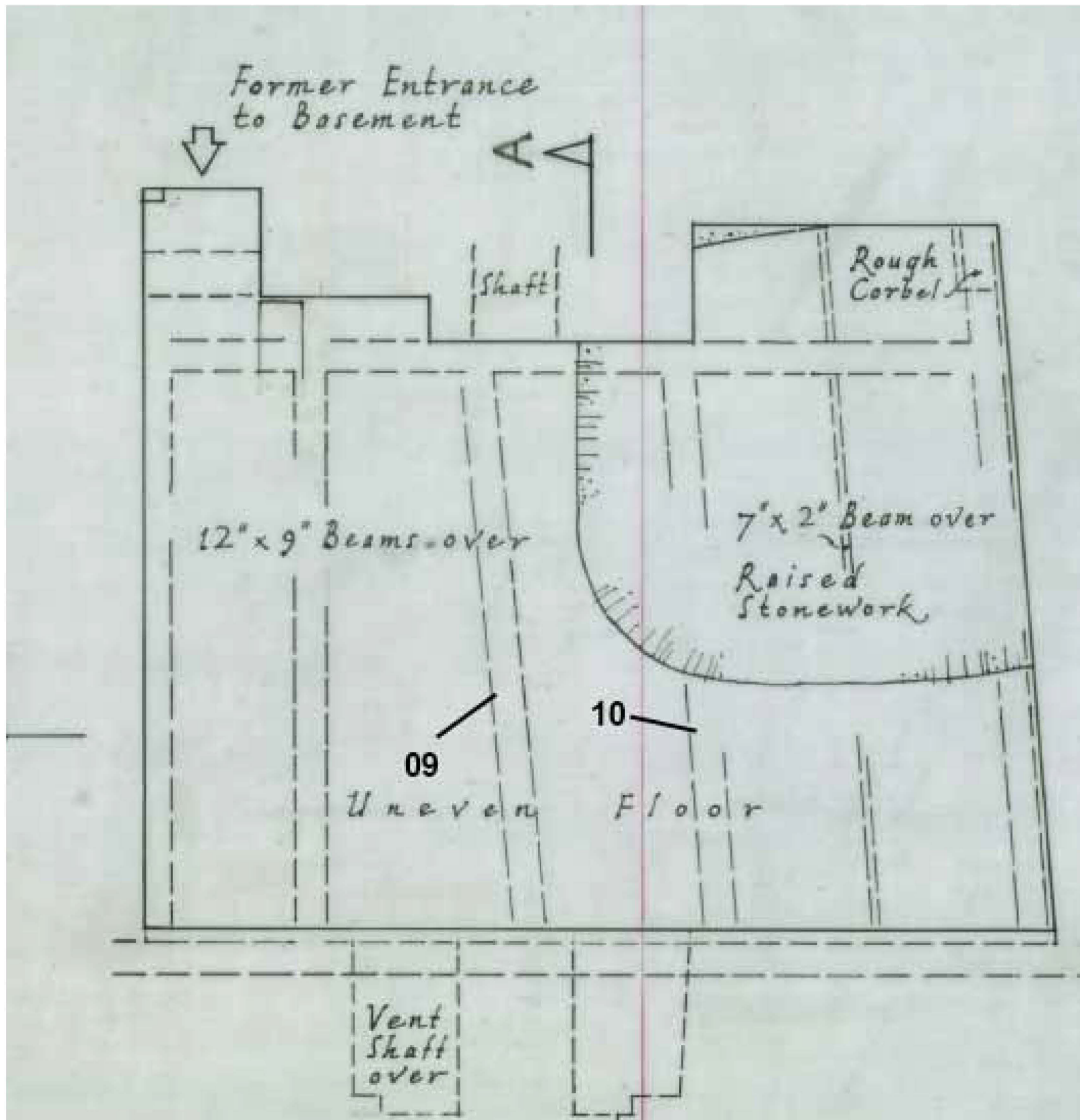


Figure 4. Part of the 1948 plans showing timbers sampled in the basement of 5 Higher Street, Dartmouth

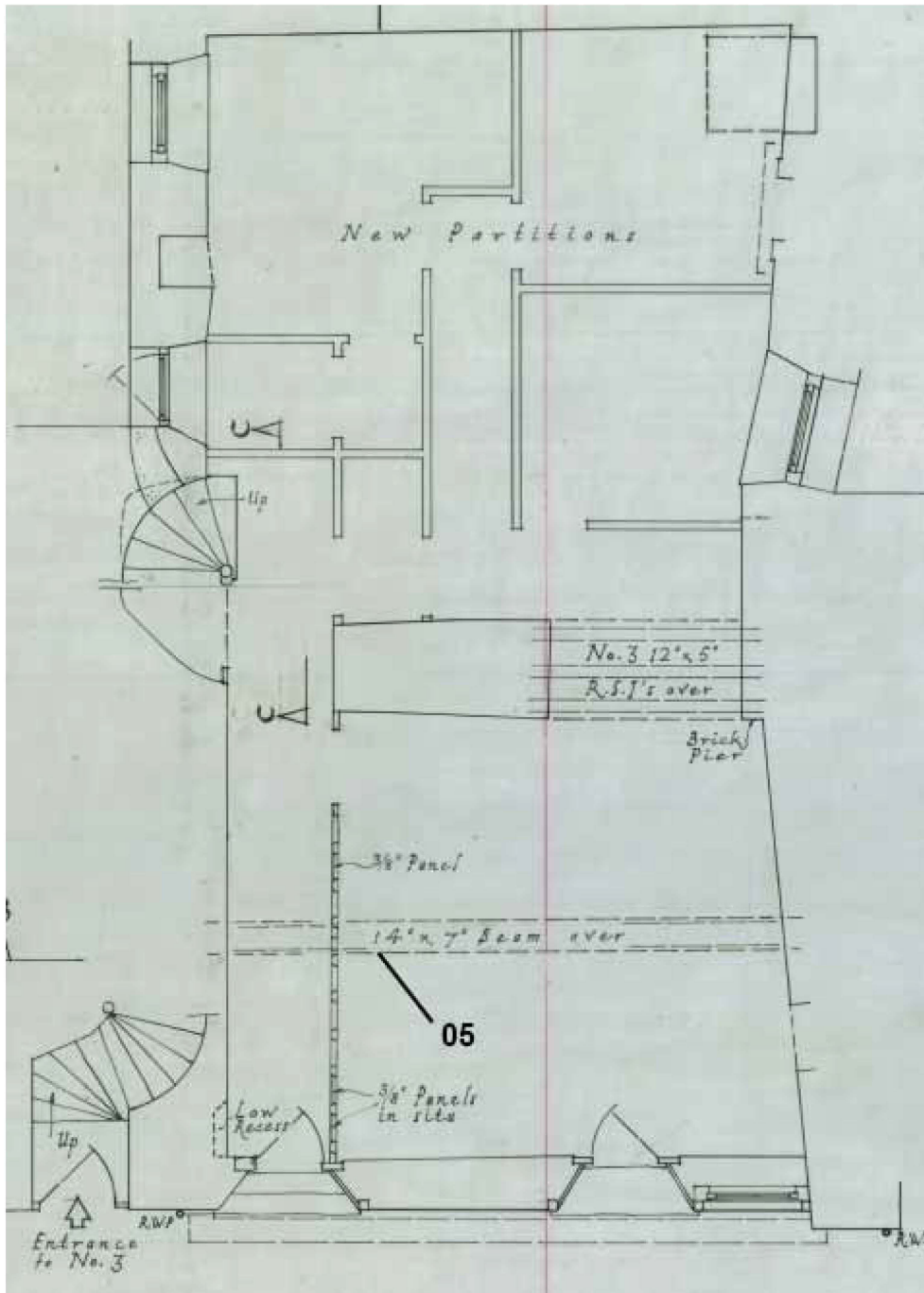


Figure 5. Part of the 1948 plans showing the timber sampled on the ground floor of 5 Higher Street, Dartmouth



*Figure 6. Higher Street (west) elevation, showing some of the timbers sampled for dendrochronology, adapted from original drawings by BBH Chartered Architects (Dartmouth) Ltd*

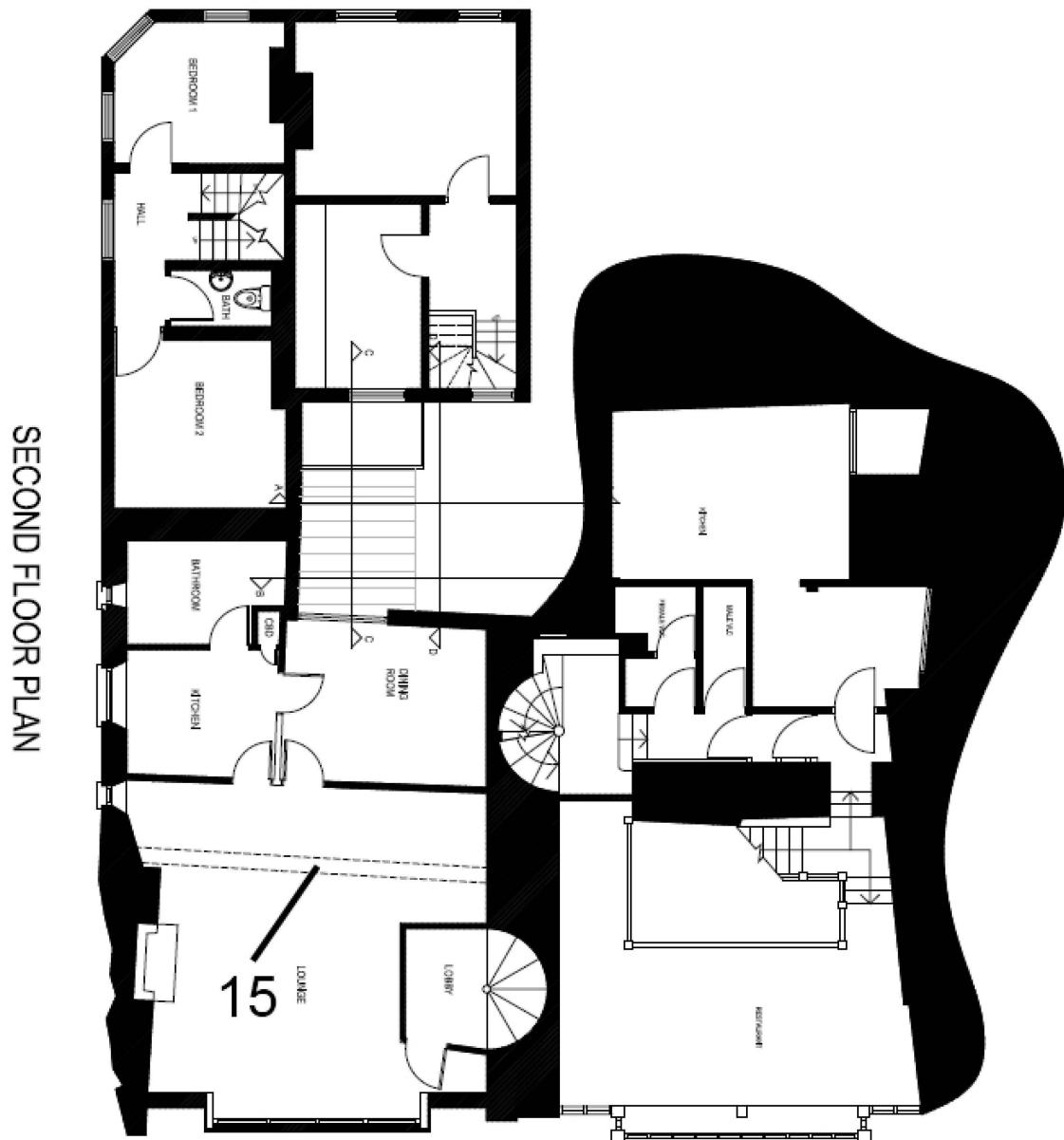


Figure 7. Second-floor plan showing the location of sample 15, adapted from original drawings by BBH Chartered Architects (Dartmouth) Ltd



*Figure 8. View of the north-south beam (centre of photograph) sampled as dtm 16*

**Table 1. Details of the samples taken for dendrochronological analysis**

Sample	Description	No of Rings	Sapwood	Mean ring-width (mm)	Mean sensitivity
5 Higher Street (south building)					
dtm01	Front south jamb to oriel window at first floor	58	h/s + 13NM	2.07	0.25
dtm02	Central inner stud to oriel window at first floor	<45	NM	-	-
dtm03	Inner mid-rail connecting studs below oriel window at first floor	<45	NM	-	-
dtm04	First stud south of central stud below oriel window at first floor	<45	NM	-	-
dtm05	Main north-south ceiling beam at ground floor level	64	-	2.79	0.23
dtm06	Ground floor ceiling joist 7 <sup>th</sup> from south end	<45	NM	-	-
3 Higher Street (central building, part of 'The Shambles')					
dtm07	North window jamb in west wall, third floor	56	h/s	1.62	0.18
dtm08	South window jamb in west wall, third floor	73	-	1.64	0.17
dtm11	Stud in west wall below window on the third floor in south room	68	35½C	0.93	0.23
dtm12	North window jamb in west wall on the third floor in north room	48	27C	2.02	0.23
dtm13	Mid-rail in panel to the north of the window, west wall, second floor	91	13(+16NM)	0.91	0.25
dtm14	South window jamb, west wall, second floor	115	30¼C	1.54	0.24
dtm15	Main north-south ceiling beam at second floor level	93	22C	1.45	0.21
Rear (east) beams between cellar and ground floor of 5 Higher Street					
dtm09	Central floor beam	48	h/s	2.43	0.20
dtm10	South floor beam	48	h/s	2.11	0.29
1 Higher Street (north part of 'The Shambles')					
dtm16	North-south ceiling beam at west end of building	89	21C	1.90	0.26

h/s = heartwood-sapwood boundary; h/s? = possible heartwood-sapwood boundary; C = complete sapwood, winter felled; ¼C = complete sapwood, felled the following spring; ½C = complete sapwood, felled the following summer; NM = not measured



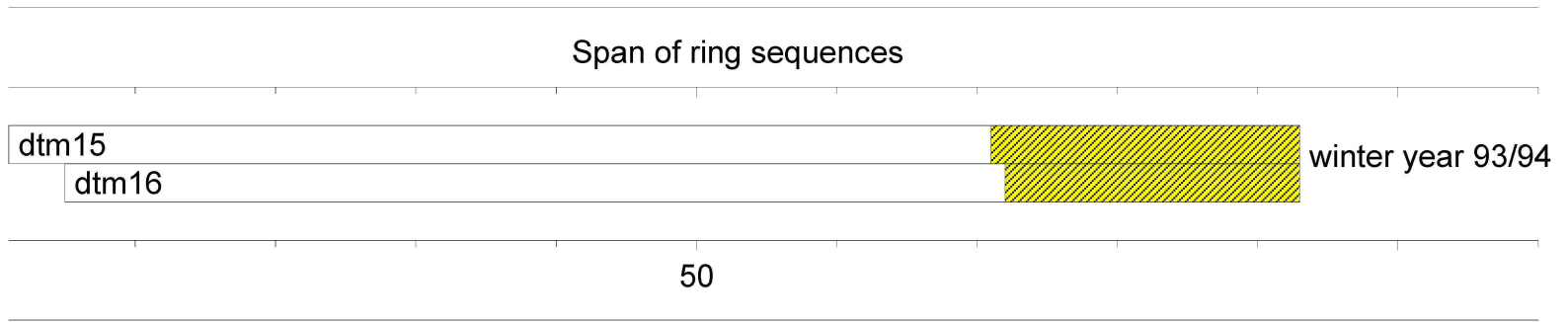


Figure 9. Bar diagram showing the relative positions of overlap and felling date for the matched but undated sequences from the two ceiling beams in 1 and 3 Higher Street. White bar represents heartwood, coloured hatched bar represents sapwood

## BIBLIOGRAPHY

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Tyers, I, 2004 *Dendro for Windows Program Guide 3rd edn*, ARCUS Report, **500b**

## APPENDIX

Ring width values (0.01mm)

dtm01

258	207	337	154	144	121	123	112	191	194
248	160	225	189	171	250	264	306	359	228
320	373	335	519	230	368	475	439	254	222
237	226	156	128	143	147	202	117	119	75
135	137	165	211	148	156	82	110	143	129
141	153	183	225	191	149	146	97		

dtm04

564	265	92	79	102	77	150	150	202	206
232	176	246	304	490	407	531	285	735	433
304	330	367	377	270	250	332	259	330	241
267	335	462	216						

dtm05

120	371	354	353	254	387	468	452	395	536
447	788	704	647	649	585	626	492	629	645
533	404	455	384	262	327	164	199	262	240
144	133	85	105	76	69	129	120	154	109
123	130	103	103	119	166	101	69	90	93
121	102	87	99	125	129	121	116	196	147
283	395	296	289						

dtm07

210	302	160	177	146	119	82	74	63	49
66	92	147	140	120	121	181	181	211	188
164	172	220	158	170	207	169	156	207	195
232	180	179	175	163	170	172	191	215	144
186	161	136	106	176	114	160	173	156	204
185	168	159	178	148	168				

dtm08

257	288	323	390	349	338	304	252	243	229
219	225	223	211	210	223	178	173	120	134
146	142	123	168	178	229	183	166	140	110
86	102	84	102	147	175	225	228	184	210
250	225	158	154	123	91	145	118	148	143
118	180	134	170	132	128	86	137	146	131
102	66	50	42	44	61	74	96	85	96
106	107	124							

dtm09

140	138	178	138	185	175	238	178	164	223
190	184	216	210	246	223	341	311	325	257
262	241	231	408	348	205	242	232	210	285
228	280	406	248	334	302	295	190	229	246
246	240	344	322	236	229	133	229		

dtm10

129	379	376	198	272	166	59	99	194	235
201	194	192	287	218	173	300	393	251	339
251	301	227	144	208	151	175	158	274	207
178	164	141	194	167	199	223	160	232	192
162	159	169	175	198	169	310	184		

dtm11

174	86	76	150	135	151	216	250	241	191
136	189	198	109	78	76	92	111	75	56
82	90	113	107	88	62	122	66	80	105
121	144	132	76	70	89	77	114	97	81
104	91	59	73	66	89	88	81	66	53
76	71	68	77	68	72	69	27	37	25
20	30	29	33	33	36	28	35		

dtm12

438	494	367	402	247	324	339	324	358	345
385	337	256	273	271	329	315	323	369	315
272	302	216	56	34	28	50	27	47	54
45	40	68	96	74	94	109	79	105	127
99	144	120	113	86	121	132	123		

dtm13

130	128	203	213	245	174	129	191	193	30
31	22	16	31	28	77	62	107	106	124
98	160	121	122	98	73	102	104	89	95
91	105	76	118	106	54	36	57	100	114
102	97	122	102	88	89	99	170	167	162
175	140	130	121	121	134	70	63	89	94
71	61	69	44	24	20	30	26	28	48
34	41	59	59	67	60	47	62	50	39
84	47	54	85	70	58	99	102	85	70
82									

dtm14

64	135	327	359	393	517	377	410	155	129
155	76	38	41	135	106	63	59	129	115
139	127	134	197	262	175	157	134	201	202
334	296	307	325	307	246	234	348	449	372
266	319	401	375	270	252	223	248	238	281
243	205	213	266	159	156	143	147	124	107
158	113	92	66	76	57	91	52	94	89
57	38	62	50	48	51	78	109	121	67
64	80	99	143	115	119	96	93	76	98
64	91	68	89	87	75	86	89	90	83
74	91	64	85	73	68	67	75	84	56
46	46	46	61	53					

dtm15

463	351	261	299	165	137	101	99	83	111
107	109	75	79	58	90	79	74	82	105
114	152	175	146	142	153	144	106	103	103

105	151	121	98	94	113	66	73	76	85
95	69	65	108	108	138	228	150	81	142
101	145	174	177	201	190	127	169	158	124
137	160	253	299	270	319	376	224	211	232
151	186	205	273	231	148	147	115	145	171
189	168	128	133	122	101	76	48	47	37
80	63	61							

dtm16

102	222	246	292	241	268	293	368	277	230
153	268	211	178	214	287	299	280	256	211
263	156	161	193	166	153	291	287	162	181
225	235	196	207	183	184	178	134	157	179
208	246	229	110	48	133	81	101	97	107
123	135	85	134	192	185	158	198	291	373
222	276	280	221	176	222	218	294	220	271
227	236	135	184	212	111	139	103	78	159
98	82	127	98	128	84	132	91	79	



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